OPERATING SUMMARY

KITCHENER

water pollution control plant

1967

ONTARIO WATER RESOURCES COMMISSION

Division of Plant Operations

ONTARIO WATER RESOURCES COMMISSION
801 BAY STREET, TORONTO 5
OFFICE OF THE GENERAL MANAGER

Members of the Kitchener Local Advisory Committee,
City of Kitchener.

Gentlemen:

We are happy to present you with the 1967 Operating Summary for the Kitchener Water Pollution Control Plant, OWRC Project No. 2-0019-58.

Your co-operation with our staff throughout the year has been appreciated. Only with such co-operation can the war against water pollution be waged effectively.

Yours very truly,

D. S. Caverly,
General Manager.

#1

ONTARIO WATER RESOURCES COMMISSION
801 BAY STREET
TORONTO 5

J. A. VANCE, LL.D.
CHAIRMAN

J. H. H. ROOT, M.P.P.
VICE-CHAIRMAN

D. S. CAVERLY
GENERAL MANAGER

W. S. MacDONNELL
COMMISSION SECRETARY

General Manager,
Ontario Water Resources Commission.

Dear Sir:

I am pleased to submit to you the 1967 Operating Summary for the Kitchener Water Pollution Control Plant, OWRC Project No. 2-0019-58.

The summary reviews progress during the year, outlines operating problems encountered and summarizes in graphs, charts and tables all significant flow and cost data.

Yours very truly,

D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

● This operating summary has been prepared in order to acquaint readers with the management of the project during 1967. The efficiency of the plant's operation is reflected in a general review. Significant financial details are recorded, and technical performance is illustrated by graphs and charts.

The summary should answer two salient questions. Are the project's facilities adequate at this time? And can the project meet future requirements?

The Regional Operations Engineer is primarily responsible for the preparation of the report, and will be pleased to answer any questions regarding it.

Most of the material for the graphs and charts was compiled by the statistics section of the Division of Plant Operations, with the final versions of the graphs being drawn by the draughting section of the Division of Sanitary Engineering. Cost data were provided by the Division of Finance.

It will be evident from the report that all of these groups co-operated with substantial success.

CONTENTS

KITCHENER
water pollution control plant

operated for

THE CITY OF KITCHENER

by the

ONTARIO WATER RESOURCES COMMISSION

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DIRECTOR: D. A. McTavish

Assistant Director: C. W. Perry
Regional Supervisor: A. C. Beattie
Operations Engineer: B. W. Hansler

801 Bay Street Toronto 5

'67 REVIEW

A total of 3843.04 million gallons of sewage was treated at the Kitchener Water Pollution Control Plant during the year at a cost of $297,754. The operating cost per million gallons was $77.48 and the cost per pound of BOD removed was $0.035.

The average daily flow of 10.53 mgd was 10.8 percent greater than the 1966 average daily flow of 9.5 million gallons. The average BOD and suspended solids concentrations were 240 mg/l and 285 mg/l respectively. The average effluent BOD and suspended solids concentrations were 18 mg/l and 14 mg/l respectively. This represents BOD and suspended solids reduction efficiencies of 92.5 percent and 95.1 percent respectively.

The average total solids of sludge pumped to the digesters was 6.9 percent. The digestion process reduced the volatile matter by an average of 52 percent, which compares favourably to existing operating criteria.

The vacuum filter did not have sufficient capacity to dewater all sludge that was produced. Excess liquid digested sludge was removed by tank truck.

During the later part of the year electrical power from the Kitchener P.U.C. was made available to the water pollution control plant making available sufficient electric power to operate the entire aeration section. Due to repairs to the plant transformer sub-station switch gear, the entire aeration section was not placed in operation before the end of the year.

Under the supervision of head office engineers, the plant staff operated a clean, attractive and efficient plant for the City of Kitchener.

PROJECT COSTS

STAGE 1

NET CAPITAL COST (Estimated) Long Term Debt to OWRC	$1,312,746.07
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1967	$ 454,113.43
Net Operating	$ 297,997.54
Debt Retirement	47,626.00
Reserve	10,827.89
Interest Charged	74,030.28
TOTAL	$ 430,481.71

RESERVE ACCOUNT

Balance at January 1, 1967	$ 80,789.44
Deposited by Municipality	10,827.89
Interest Earned	4,816.53
	$ 96,433.86
Less Expenditures	(5,495.64)
Balance at December 31, 1966	$ 90,938.22

STAGE 2

NET CAPITAL COST (Estimated)		$1,488,607.70
DEDUCT - Portion Financed by CMHC (Estimated)		1,016,967.77
Long Term Debt to OWRC		$ 471,639.93
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1967		$ 91,643.44
Net Operating		$ -
Debt Retirement		17,111.00
Reserve		9,534.89
Interest Charged		26,597.36
TOTAL		$ 53,243.25

RESERVE ACCOUNT

Balance at January 1, 1967		$ 31,480.03
Deposited by Municipality		9,534.89
Interest Earned		1,990.73
		$ 43,005.65
Less Expenditures		(2,871.12)
Balance at December 31, 1967		$ 40,134.53

MONTHLY OPERATING COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	* SUNDRY	WATER
JAN	14487.96	8001.38	578.19	2251.28	2797.64	72.21	132.79	472.44	172.03	
FEB	21031.52	7958.35	700.63	2483.06	1097.85	466.27		926.75	7398.61	
MARCH	29922.06	12543.29	680.01	2550.51	6548.40	386.95	65.56	1097.18	6050.16	
APRIL	25117.63	8054.47	358.82	2607.28	6869.86	256.85	1031.07	374.13	5565.15	
MAY	24558.96	8954.32	514.77	2487.14	6609.67	383.04	210.55	654.10	4692.63	52.74
JUNE	22386.55	7974.00	798.85	2393.54	4068.36	1055.13	27.30	1351.58	4717.79	
JULY	25165.57	8312.09	1169.15	2298.44	5061.04	587.80	322.10	1941.27	5473.68	
AUG	26484.06	9409.91	1286.45	2348.93	6488.23	380.73	549.56	643.58	5376.67	
SEPT	29662.92	13333.26	533.46	2472.97	5896.91	409.13	309.99	1245.30	5418.61	
OCT	20864.37	8685.11	312.10	2351.25	3592.20	659.16	248.55	127.96	4908.04	
NOV	27362.38	9243.35		2509.55	5639.99	776.57		1103.14	8089.78	
DEC	30690.18	8601.85		2539.61	5124.71	812.91	(4.50)	1626.16	11913.21	76.23
TOTAL	297754.16	111081.38	6932.43	29293.56	59794.86	6246.75	2892.97	11563.59	69776.36	172.26

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE $65,591.82
BRACKETS INDICATE CREDIT

YEARLY OPERATING COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER MILLION GALLONS	COST PER LB OF BOD REMOVED
1961	2649.60	$118,269.00	$50.30	3.8 CENTS
1962	3254.55	100,007.00	30.72	2.4 CENTS
1963	2841.14	137,547.00	49.46	2.8 CENTS
1964 **	3026.52	217,425.00	71.84	1.7 CENTS
1965	3328.10	225,144.00	67.65	2.0 CENTS
1966	3457.80	279,143.00	80.73	3.6 CENTS
1967	3843.04	297,754.00	77.48	3.5 CENTS

** AERATION PORTION OF PLANT PLACED IN OPERATION

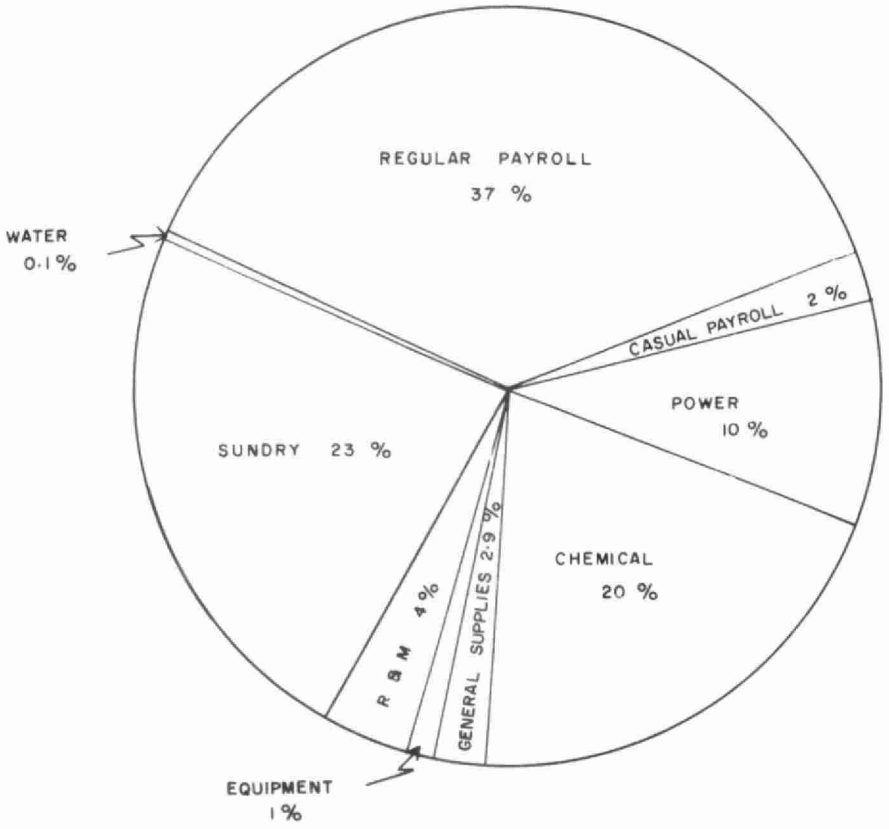
VACUUM FILTER COSTS (MONTHLY)

MONTH	COST PER MONTH					TOTAL	COST PER TON DRY WEIGHT					TOTAL
	$FeCl_3$	CAO	LABOUR	ELEC	MAINT		$FeCl_3$	CAO	LABOUR	ELEC	MAINT	
JANUARY	1682.75	1626.74	1731.21	317.73	137.12	5495.55	5.40	5.22	5.56	1.02	0.44	17.64
FEBRUARY	2202.63	1016.54	1731.21	293.56	137.12	5981.06	7.65	5.62	6.02	1.02	0.48	20.79
MARCH	1413.50	1550.68	1508.30	391.22	127.42	4961.62	5.52	6.05	5.88	1.02	0.50	19.37
APRIL	1440.58	1471.22	1591.32	239.65	126.04	4868.81	5.13	6.26	6.77	1.02	0.54	20.72
MAY	1805.95	1816.94	1941.06	302.34	153.73	6020.52	6.08	6.12	6.54	1.02	0.52	20.28
JUNE	1221.49	1407.90	1468.91	239.14	116.34	4453.78	5.21	6.01	6.27	1.02	0.50	19.01
JULY	1548.07	1662.38	1836.14	314.21	145.42	5506.22	5.03	5.40	5.96	1.02	0.47	17.88
AUGUST	1603.33	1628.78	1818.65	318.65	144.04	5513.45	5.13	5.21	5.82	1.02	0.46	17.64
SEPTEMBER	1318.92	1333.50	1468.91	241.95	116.34	4479.62	5.56	5.62	6.19	1.02	0.49	18.85
OCTOBER	865.35	852.05	909.32	156.32	72.02	2855.06	5.65	5.56	5.93	1.02	0.47	18.63
NOVEMBER	856.18	873.47	926.81	157.90	73.40	2887.76	5.53	5.64	5.99	1.02	0.47	18.65
DECEMBER	500.56	434.48	454.66	63.34	36.01	1489.05	3.06	7.00	7.32	1.02	0.58	23.98
TOTAL	16459.31	16274.68	17487.00	2906.51	1385.00	54512.50						
AVERAGE PER MONTH	1371.61	1356.22	1457.25	242.21	115.42	4542.71	5.91	5.81	6.22	1.02	0.49	19.46

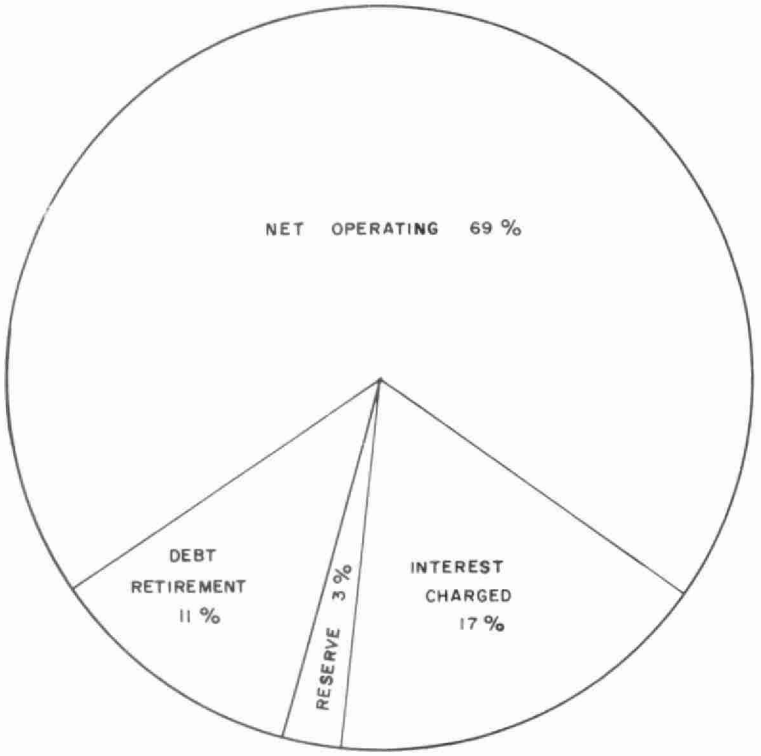
COMMENTS

The average operating cost per ton of solids filtered was $19.46.

1967 OPERATING COSTS



TOTAL ANNUAL COST



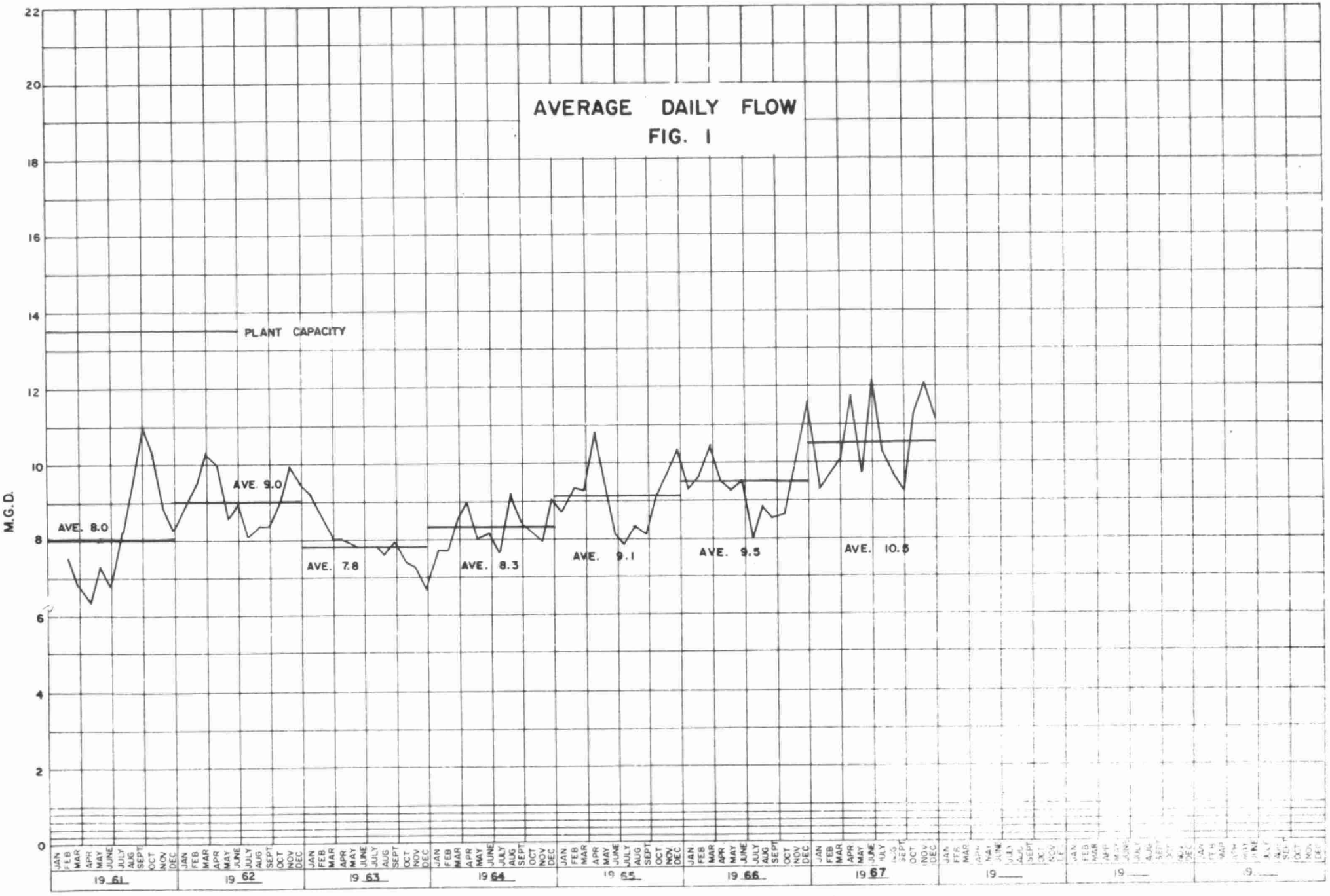
Process Data

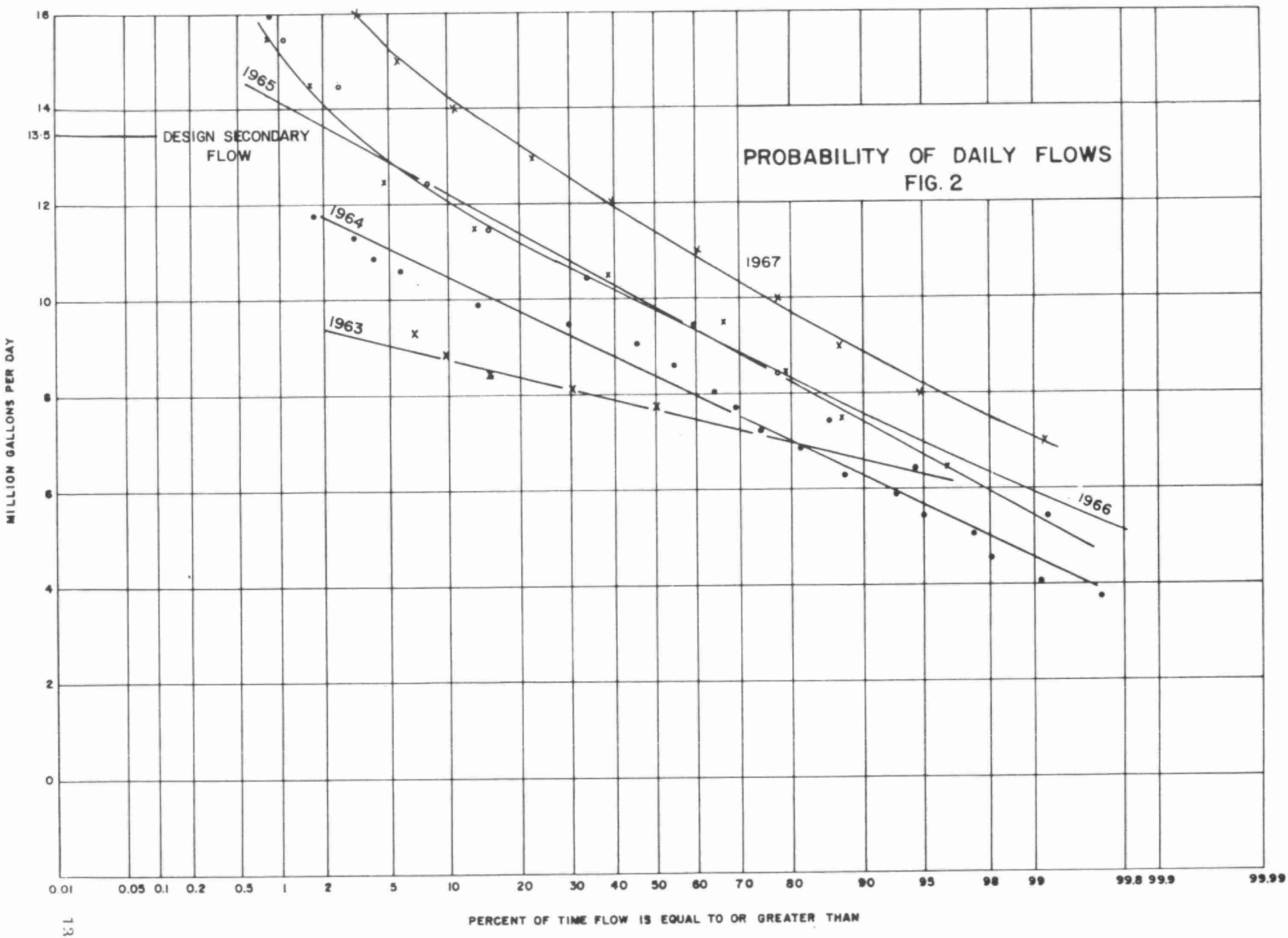
The total daily flows averaged by month for the period of February 1961 to December 1967 are shown in Figure No. 1. The average daily flow for 1967 of 10.53 mgd increased 10.8 percent as compared to the average daily flow of 9.5 mgd in 1966. During the past year 3843.04 million gallons of raw sewage composed of both domestic and industrial wastes received complete treatment.

The maximum monthly average daily flow was 12.09 mgd and occurred in June. The average daily flow of 10.53 mgd was exceeded, averaged on a monthly basis, during the months of April, June, October, November and December.

There are four aeration tanks with a design flow of 13.5 mgd. However, because of electric power supply limitations only 75 percent of the aeration section was utilized. As a result, the design flow for the aeration section portion that was utilized is 10.1 mgd. The average daily flow exceeded the design primary and aeration section design values for 11.0 mg and 10.1 mgd, 58 percent and 72 percent of the time respectively.

Probability flow curves for 1963 to 1967 inclusive are illustrated on Figure No. 2.


AVERAGE DAILY FLOW
FIG. 1
M.G.D.
PLANT CAPACITY
AVE. 8.0
AVE. 9.0
AVE. 7.8
AVE. 8.3
AVE. 9.1
AVE. 9.5
AVE. 10.5
19 61
19 62
19 63
19 64
19 65
19 66
19 67


PROBABILITY OF DAILY FLOWS
FIG. 2
DESIGN SECONDARY FLOW
13.5
1965
1964
1963
1967
1966
MILLION GALLONS PER DAY
16
14
12
10
8
6
4
2
0
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PERCENT OF TIME FLOW IS EQUAL TO OR GREATER THAN

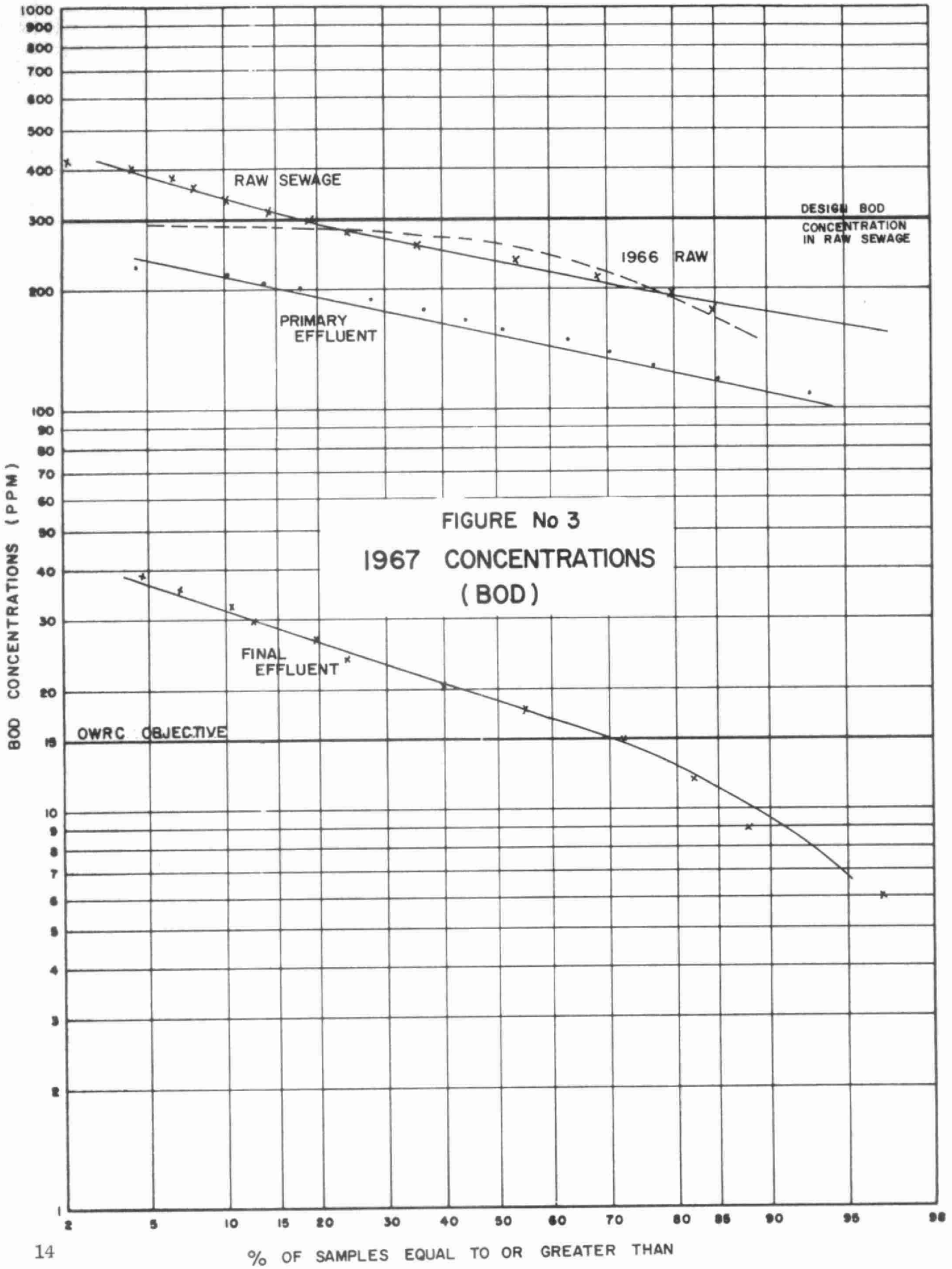


FIGURE No 3

1967 CONCENTRATIONS

(BOD)

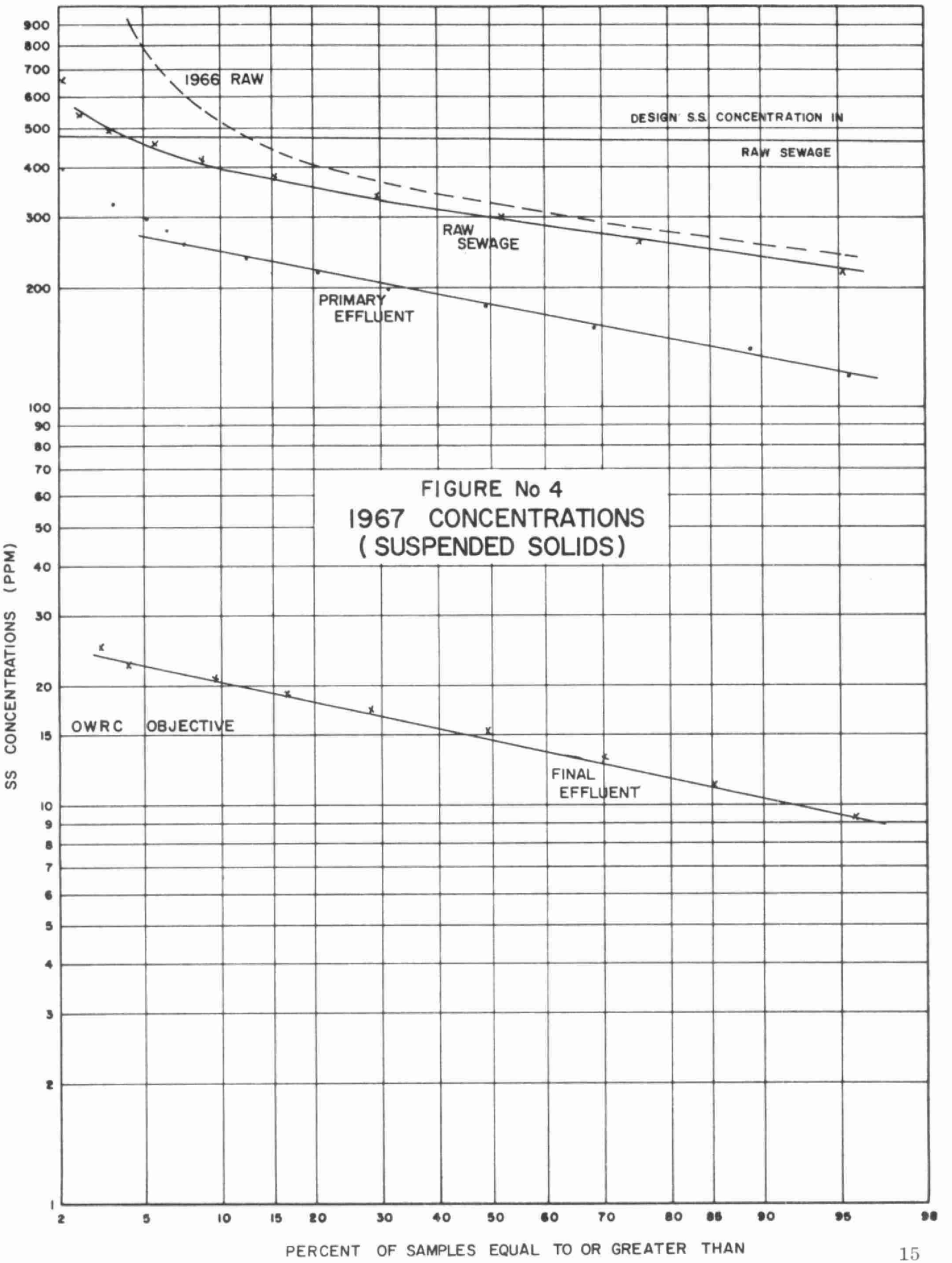
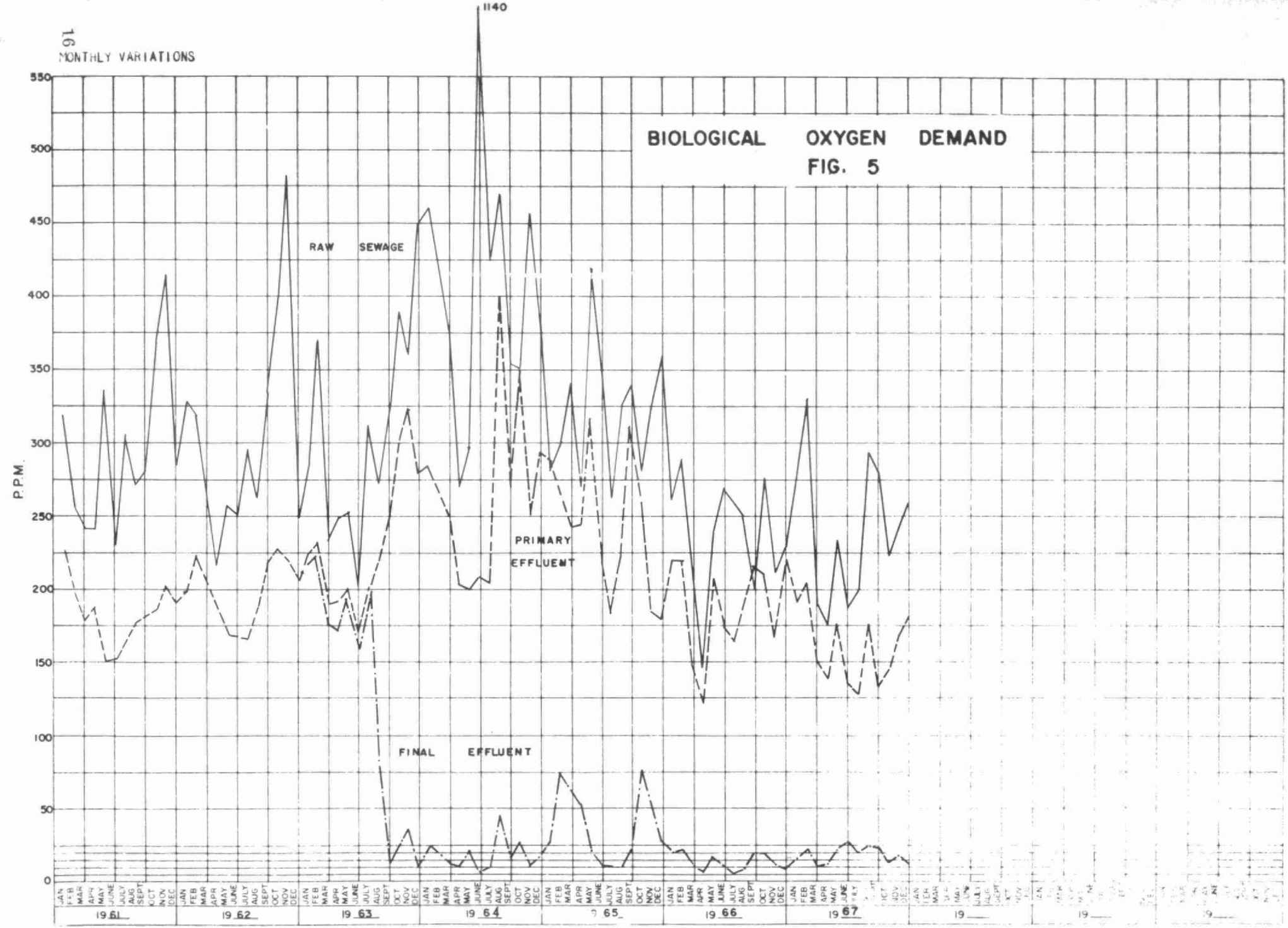


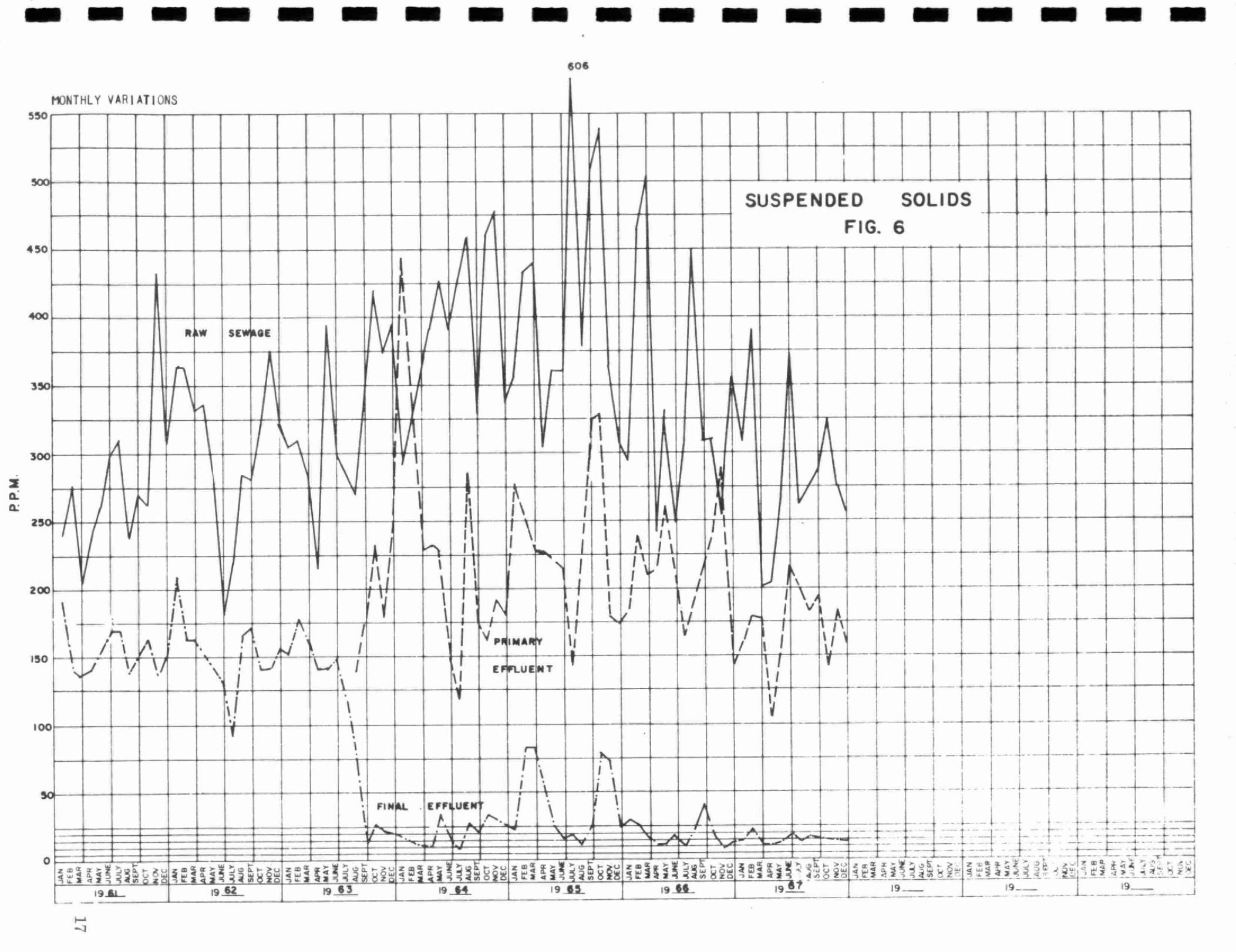
FIGURE No 4
1967 CONCENTRATIONS
(SUSPENDED SOLIDS)

MONTHLY VARIATIONS

BIOLOGICAL OXYGEN DEMAND

FIG. 5




606
MONTHLY VARIATIONS
SUSPENDED SOLIDS
FIG. 6
RAW SEWAGE
PRIMARY
EFFLUENT
FINAL EFFLUENT
P.P.M.
550
500
450
400
350
300
250
200
150
100
50
0
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
19 61
19 62
19 63
19 64
19 65
19 66
19 67
19 ____

GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	275	17	93. 8	372. 80	308	14	95. 5	424. 81	941
FEB.	329	22	93. 3	414. 96	290	21	94. 6	498. 76	1183
MAR.	190	10	94. 7	284. 97	200	11	94. 5	299. 22	847
APR.	175	11. 5	93. 4	285. 18	204	10	95. 1	348. 77	924
MAY	233	21	91. 0	319. 91	269	12	95. 5	386. 30	758
JUNE	186	27	85. 5	288. 35	370	17	95. 4	640. 16	1155
JULY	198	19	90. 4	284. 75	261	13	95. 0	394. 52	1057
AUG.	292	23	92. 1	401. 08	275	16	94. 2	386. 17	1008
SEPT.	278	22	92. 1	356. 86	286	15	94. 8	377. 77	770
OCT.	221	12	94. 6	365. 75	324	14	95. 7	542. 50	749
NOV.	242	16	93. 4	407. 48	275	13	95. 3	472. 39	749
DEC.	257	12	95. 3	422. 06	256	12	95. 3	420. 34	665
TOTAL	-	-	-	4204. 12	-	-	-	5191. 71	10806
AVG.	240	18	92. 5	350. 34	285	14	95. 1	432. 64	901

COMMENTS

The BOD and suspended solids concentrations, based on twenty-four hour composite samples of raw sewage, primary effluent and plant effluent are presented on probability plots in Figures No. 3 and 4 respectively. The average monthly influent, primary effluent and plant effluent BOD and suspended solids concentrations, are plotted on an arithmetic basis on Figures No. 5 and 6 respectively.

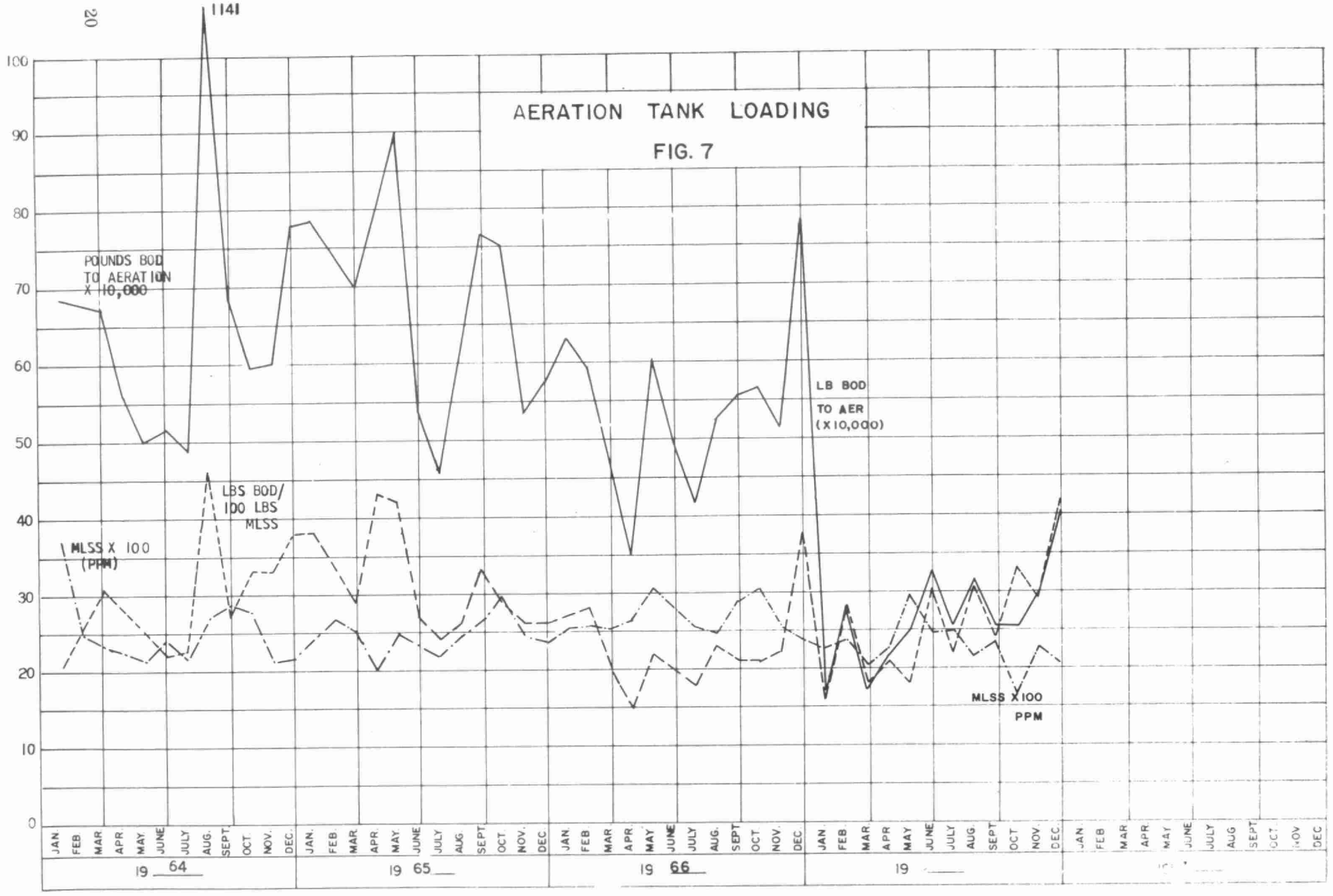
The average raw sewage BOD concentration of 240 mg/l was 80 percent of the design value of 300 mg/l. Figure No. 3 indicates that the raw sewage BOD design value was exceeded 19 percent of the time. The raw sewage BOD design value was not exceeded in 1966. A total of 4204 tons of BOD was removed in 1967. The average BOD reduction efficiency was 92.5 percent.

The average plant effluent BOD concentration was 18 mg/l. The OWRC objective of 15 mg/l for plant effluent BOD was exceeded 72 percent of the time.

The average raw sewage suspended solids concentration of 285 mg/l represents 63% of the design concentration of 450 mg/l. Figure No. 4 indicates that the raw sewage suspended solids concentration exceeded the design figure 12 percent of the time. A total of 5192 tons of suspended solids was removed in 1967. The average suspended solids reduction was 95.1 percent.

The average plant effluent suspended solids concentration was 14 mg/l. The plant effluent suspended solids exceeded the OWRC objective of 15 mg/l 45 percent of the time.

A total of 10,806 cubic feet of grit was removed during the year. This is equivalent to 2.92 cubic feet of grit per million gallons of sewage treated.

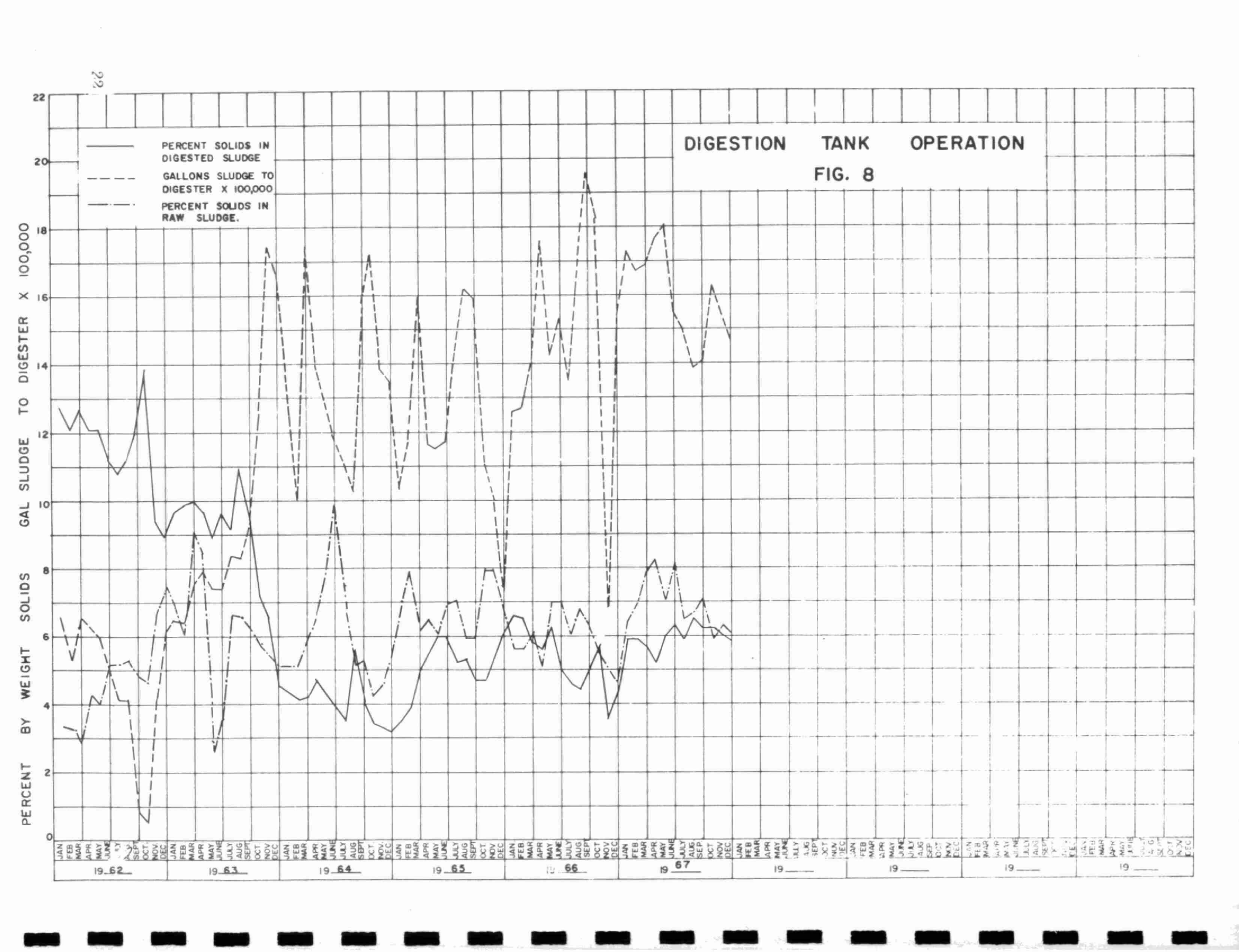

AERATION TANK LOADING
FIG. 7
1141
POUNDS BOD
TO AERATION
X 10,000
LBS BOD/
100 LBS
MLSS
MLSS X 100
(PPM)
LB BOD
TO AER
(X10,000)
MLSS X100
PPM
100
90
80
70
60
50
40
30
20
10
0
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
19 64
19 65
19 66
19

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. B.O.D. PER 100 LBS. M. L. S. S.
JANUARY	190	2375	25
FEBRUARY	204	3397	20
MARCH	150	2472	21
APRIL	138	2416	23
MAY	174	2512	23
JUNE	136	2904	20
JULY	128	2431	18
AUGUST	176	2398	24
SEPTEMBER	133	2501	17
OCTOBER	144	2152	26
NOVEMBER	167	2149	32
DECEMBER	180	2631	26
TOTAL	-	-	-
AVERAGE	160	2528	23

COMMENTS

The average MLSS concentration of 2528 mg/l and the organic loading ratio of 23 pounds of BOD per 100 pounds of MLSS are within the accepted limits of good aeration tank operation. The BOD in pounds to the aeration section and the MLSS concentrations averaged on a monthly basis are plotted on Figure No. 7.


DIGESTION TANK OPERATION
FIG. 8
PERCENT SOLIDS IN DIGESTED SLUDGE
GALLONS SLUDGE TO DIGESTER X 100,000
PERCENT SOLIDS IN RAW SLUDGE.
PERCENT BY WEIGHT SOLIDS GAL SLUDGE TO DIGESTER X 100,000
0
2
4
6
8
10
12
14
16
18
20
22
19 62
19 63
19 64
19 65
19 66
19 67
19 ____
19 ____
19 ____
19 ____

DIGESTER OPERATION

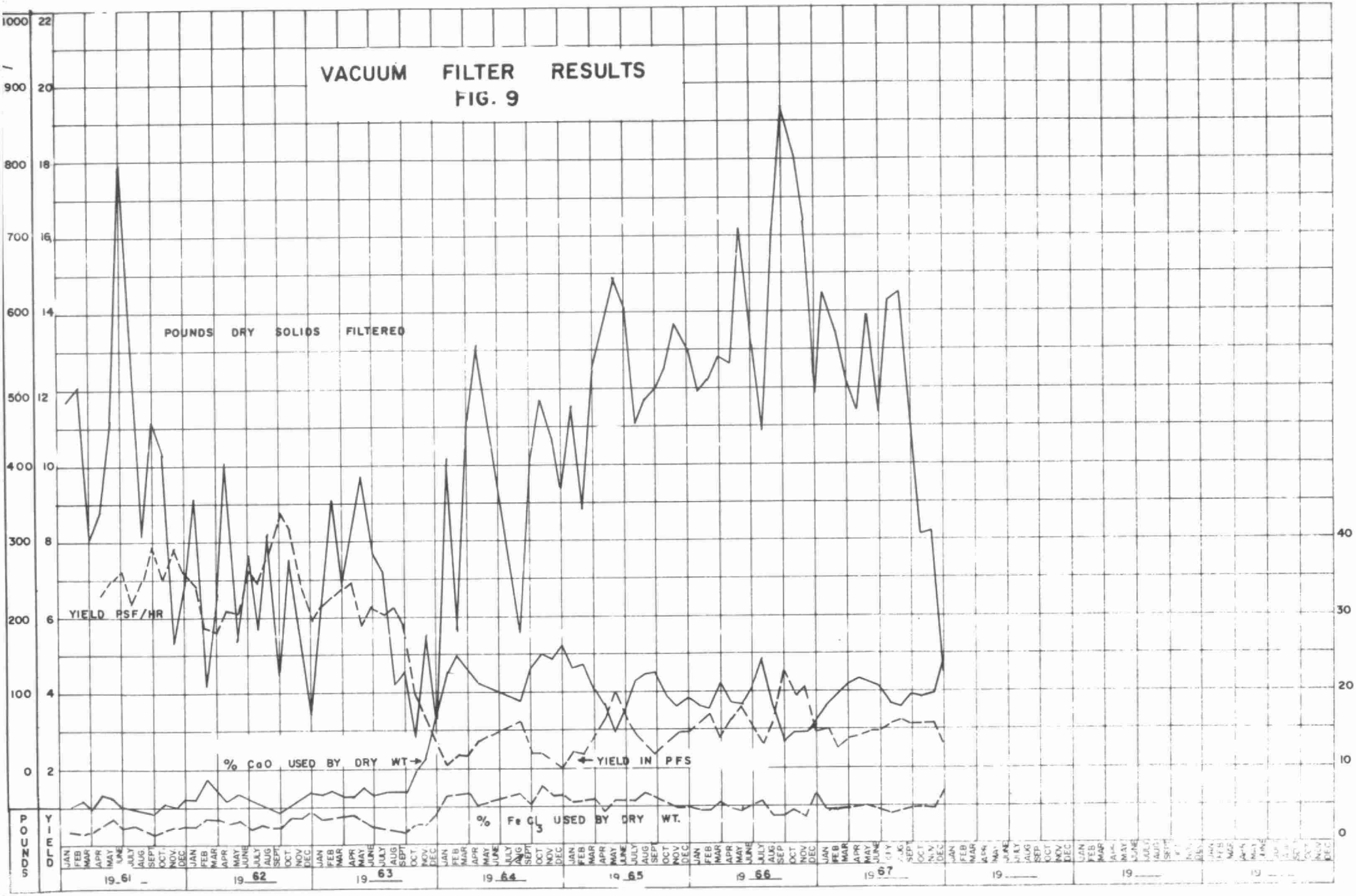
MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS		
	1000'S GALLONS	% SOLIDS	% VOL MAT	1000'S GALLONS	% SOLIDS	% VOL MAT
JAN.	1729.900	6.4	-	1841.300	5.9	-
FEB.	1677.500	6.9	73.90	1618.000	5.9	45.30
MAR.	1687.500	7.8	73.00	1543.300	5.7	56.00
APR.	1761.500	8.2	67.00	1333.950	5.2	54.00
MAY	1805.800	7.0	75.00	1428.100	6.0	54.00
JUNE	1554.300	8.1	62.00	2020.500	6.3	51.00
JULY	1496.700	6.5	65.00	2161.385	5.9	48.00
AUG.	1391.700	6.7	72.00	1998.000	6.5	48.00
SEPT.	1402.800	7.1	76.00	1981.600	6.2	52.00
OCT.	1626.700	5.9	71.00	1901.600	6.2	52.00
NOV.	1548.400	6.3	74.30	1977.200	6.0	51.00
DEC.	1471.000	6.1	73.00	1705.700	5.8	54.00
TOTAL	19153.800	-	-	21511.635	-	-
AVG.	1596.150	6.9	71.11	1792.636	6.0	51.40

COMMENTS

An average of 1.60 million gallons of sludge per month was pumped to the primary digesters. The sludge average 6.9% total solids, of which 65.2% was volatile matter. Digested sludge from the primary digester averaged 6.0% total solids of which 47.1% was volatile matter. The average reduction in volatile matter was 52%. This compares favourably with existing comparative criteria.

Sludge and digester data are represented graphically on Figure No. 8.

VACUUM FILTER RESULTS
FIG. 9



VACUUM FILTER OPERATION

MONTH	% SOLIDS FILTRATE	FILTER HOURS	% SOLIDS SLUDGE	LBS. DRY SOLIDS FILTERED	LBS. LIME (AS CaO)	% LIME (AS CaO)	LBS. $FeCl_3$	% $FeCl_3$	% SOLIDS FILTERED SLUDGE	YIELD PSF/HOUR
JAN.	0.9	360.5	5.3	623,000	111650	17.9	26668	4.3	23.0	3.4
FEB.	1.2	368.0	5.2	575,600	110950	19.3	24907	4.3	21.1	2.5
MAR.	0.8	343.0	5.6	512,200	106430	20.8	22401	4.4	23.5	2.7
APR.	1.1	340.0	5.6	469,900	100975	21.5	22474	4.8	23.0	2.6
MAY.	2.2	412.5	6.1	593,800	124705	21.0	20174	4.7	23.0	2.9
JUNE	1.9	311.7	6.3	468,900	96630	20.6	19056	4.1	27.0	2.9
JULY	1.8	332.0	6.3	616,100	114095	18.5	23364	3.8	28.0	3.1
AUG.	2.2	386.5	6.6	624,800	111790	17.9	25013	4.0	27.0	3.2
SEPT.	2.3	312.0	5.8	474,418	91525	19.3	20576	4.3	27.0	3.1
OCT.	1.8	193.0	6.1	306,500	58480	19.1	13500	4.4	28.0	3.1
NOV.	1.9	197.0	6.0	309,600	59950	19.4	13357	4.3	28.0	3.1
DEC.	1.6	85.5	4.7	124,200	29820	24.0	7809	6.3	22.0	2.8
TOTAL		3721.7		5699,018	1117000		247693			
AVG.	1.6	310.1	5.9	474,918	93083	19.6	20658	4.3	24.2	2.9

COMMENTS

A total of 5,699,018 pounds of dry solids were filtered during the year. Vacuum filtration increased the average solids concentration from 5.9% to 24.2%. Vacuum filter data is plotted on Figure No. 9.

The average vacuum filter yield of 2.9 psf/hour was 15 percent less than the average filter yield of 3.4 psf/hour in 1966. An average vacuum filter yield of 2.9 psf/hour is a low average figure as compared to established criteria.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (PPM)
JANUARY	288.99	* 5590	4.00
FEBRUARY	270.33	* 3290	3.78
MARCH	316.63	12675	4.00
APRIL	352.29	14265	4.05
MAY	301.80	15000	4.97
JUNE	362.70	17120	4.72
JULY	318.16	14890	4.68
AUGUST	298.20	14650	4.91
SEPTEMBER	278.80	7735	3.08
OCTOBER	350.00	9360	3.60
NOVEMBER	360.60	14660	4.06
DECEMBER	344.54	13075	3.79
TOTAL	3843.04	142310	-
AVERAGE	320.25	11859	3.70

* Chlorine system under overhaul.

COMMENTS

An average chlorine dosage rate of 4.36 ppm was required to maintain a chlorine residual of 0.5 ppm in the final effluent.

CONCLUSIONS

The average BOD and suspended solids reduction efficiencies were 92.5 percent and 95.1 percent respectively.

The average daily flow for the year was 10.53 million gallons which is approaching the primary section design value of 11.0 million gallons per day.


ONTARIO WATER RESOURCES COMMISSION